

## Blended Learning for teaching Renal Pathology in Medical Residency – a report

*Ensino híbrido para ensino de patologia renal na residência médica: um relato*

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### ABSTRACT

**Introduction:** Blended Learning can be used as a pedagogical resource to the traditional ways of teaching. The lack of a Renal Pathology laboratory can result in a gap in the training of resident physicians in Nephrology. This study describes how complementing the content with the use of an online Renal Pathology atlas was described by resident physicians.

**Experience report:** A virtual atlas of Renal Pathology prepared by preceptors of the Medical Residencies of Nephrology and Pathology was presented to eight resident physicians enrolled in the service, who, for fifteen days, included the studies of this content in their activities. The residents evaluated the teaching-learning experience through a focus group.

**Discussion:** Online teaching strategies can be used to complement the knowledge acquired during Medical Residency. However, it is important that this stage of the blended learning strategy be motivating in the students' view, adapting to the moment experienced by resident physicians, who already have a pre-determined workload. These points were among the emerging topics in the thematic analysis of the content of the focus group, which also included suggestions from the students on how to modify the content presentation.

**Conclusion:** The inclusion of blended learning strategies can help the training of resident physicians, as well as open space for student production. Inter-institutional partnerships should be developed to overcome barriers to e-learning development by medical trainers.

**Keywords:** Educational technology; Pathology; nephrology.

### RESUMO

**Introdução:** O ensino híbrido pode ser utilizado como recurso pedagógico às formas tradicionais de ensinar. A ausência de um laboratório de patologia renal pode gerar uma lacuna na formação de médicos residentes em nefrologia. Este estudo descreve como a complementação do conteúdo com o uso de um atlas on-line de patologia renal foi descrita por médicos residentes.

**Relato de experiência:** Um atlas virtual de patologia renal elaborado por preceptores das residências médicas de nefrologia e patologia foi apresentado a oito médicos residentes matriculados no serviço, que, durante 15 dias, incluíram os estudos desse conteúdo em suas atividades. Os residentes avaliaram a experiência de ensino-aprendizagem por meio de um grupo focal.

**Discussão:** Estratégias de ensino on-line podem ser utilizadas para complementar o conhecimento adquirido durante a residência médica. No entanto, é importante que essa etapa da estratégia de ensino híbrido seja motivadora na visão do estudante e se adapte ao momento vivenciado pelos médicos residentes, os quais já possuem carga de trabalho determinada. Esses pontos estiveram entre os temas emergentes na análise temática do conteúdo do grupo focal, que também incluiu sugestões dos alunos em como modificar a apresentação do conteúdo.

**Conclusão:** A inserção de estratégias de ensino híbrido pode auxiliar a formação dos médicos residentes, bem como abrir espaço para a produção discente. Parcerias interinstitucionais devem ser desenvolvidas para suprir barreiras à elaboração de e-learning pelos formadores médicos.

**Palavras-chave:** Tecnologia Educacional; Patologia; Nefrologia.

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## INTRODUCTION

The interpretation of images obtained in Renal Pathology is among the skills of the nephrologist's last year of training<sup>1</sup>. These images influence the specialist's practice in the correct referral and filling out of samples to send to the pathologist, favoring the adequate interpretation of their results, and in determining the prognosis and treatment of each case<sup>2-4</sup>. Few training centers in Nephrology in Brazil have an available renal anatomopathological laboratory, and inter-institutional partnerships are created to fill this gap.

The inclusion of educational technologies has helped the teaching of Medicine, through the possibility of including new ways of teaching, the use of multimedia resources and by providing objective literature. Among the several available study strategies, medical students' preference for the inclusion of technology can be observed<sup>5</sup>. However, although medical students have access to electronic devices, they are not always able to apply their resources to their academic benefit, requiring teaching participation in the process<sup>6,7</sup>. By allowing Distance Learning, the creation of technological resources can be used to meet the deficiencies of training centers, sharing human and technological resources from other centers<sup>8</sup>.

E-learning is an educational process related to the use of educational technologies through Information and Communication Technologies, using the Internet<sup>9</sup>. In the teaching of Pathology, the use of e-learning can substitute classes that traditionally require the presentation of images through slides in laboratories<sup>10-13</sup>. While the lack of contact with the teacher can limit the use of e-learning during Medical Residency, Blended Learning, which is defined as an active teaching-learning method that finds intersections between traditional teaching (face-to-face meetings) and the use of online activities can be applicable to the training of health professionals<sup>14</sup>, the teaching of Pathology<sup>15</sup>, and as a complementary method in Medical Residency<sup>16,17</sup>.

When the lack of didactic resources for teaching Renal Pathology to a group of residents was identified, this content was presented as complementary method through a virtual atlas. The aim of this study is to analyze how a group of resident physicians in Internal Medicine and Nephrology described the experience of learning aided by the developed pedagogical resource.

## EXPERIENCE REPORT

The technological product – NefroAtlas – was developed through an inter-institutional partnership with the participation of: a nephrologist, preceptor of the Nephrology Medical Residency Program at Hospital Universitário Onofre Lopes of Universidade Federal do Rio Grande do Norte (HUOL/

UFRN) and a pathologist specialized in Renal Pathology and coordinator of the Laboratory of Immunofluorescence and Electronic Microscopy at Universidade Federal do Maranhão; in addition to a technical development team, which included a teacher and students from the Bachelor's Degree Course in Information Technologies from Instituto Metr pole Digital (IMD/UFRN). The educational product was published in an online format<sup>18</sup> (Figure 1).

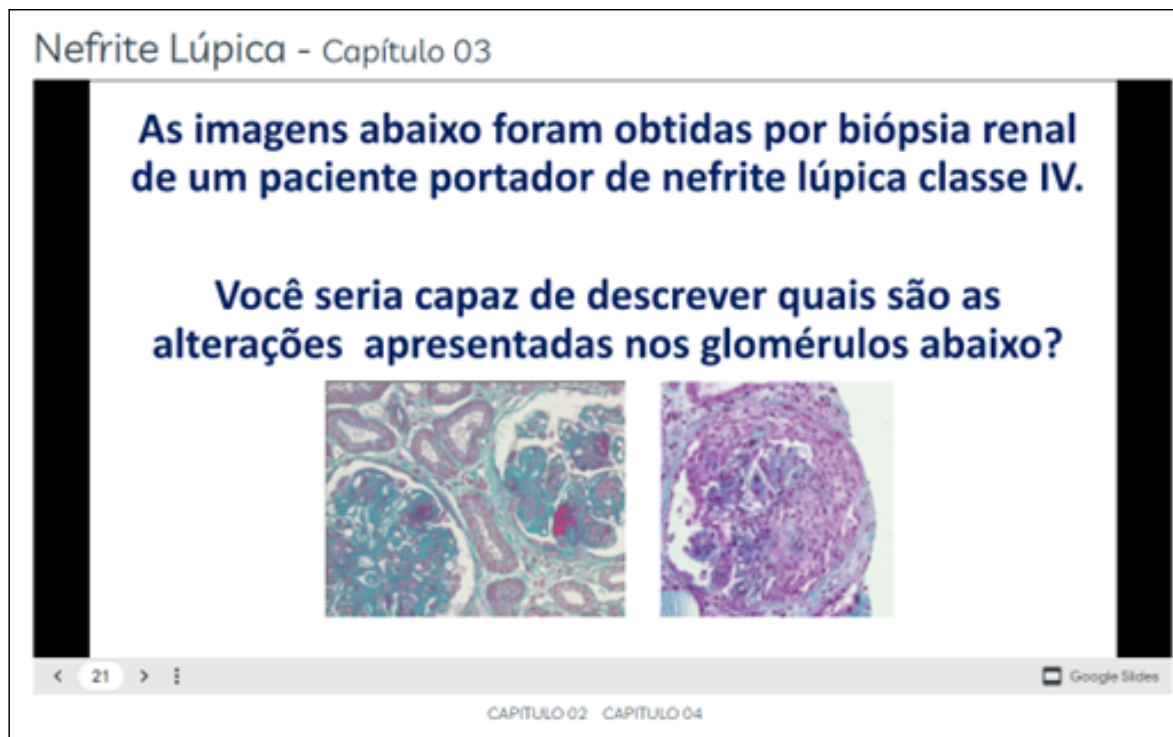
The teaching methodology was based on Blended Learning, which was used as a complement to the resident physician's training, where the following moments were considered: in-person (experience in the Nephrology residency) and online (study through the atlas). Didactic resources such as: inclusion of explanatory texts, pathology image highlights, use of clinical cases and clinical reasoning direction were used in each topic (Figures 2 and 3). Moreover, self-assessment tests with objective questions were made available (Figure 4). The images were chosen from the collection of the Renal Pathology Laboratory, presenting the main structures of the two topics (Normal Kidney and Lupus Nephritis), including the optical microscopy analysis of Masson's Trichrome, Jones methenamine silver and others, and Immunofluorescence reactions.

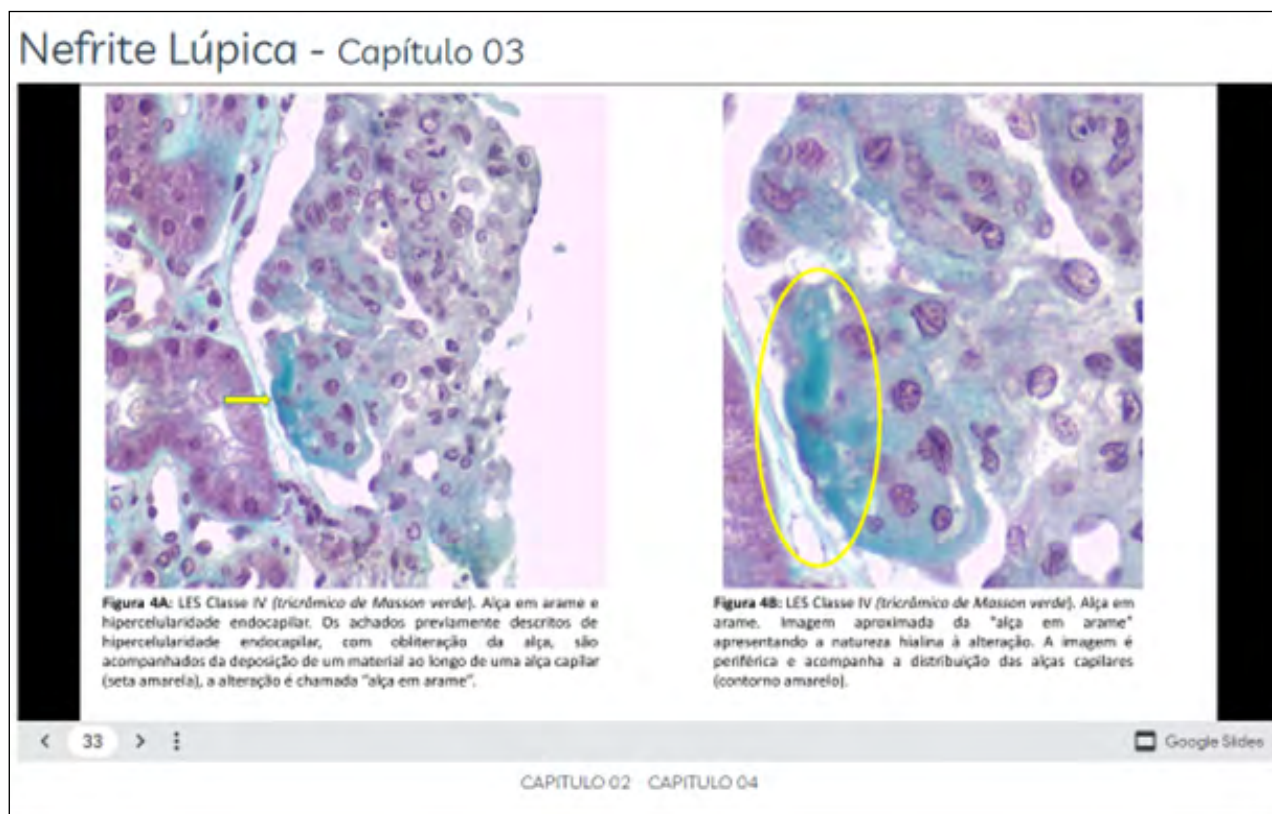
A qualitative, descriptive research was developed to assess the platform. The aim of the study was included in level 1 of Kirkpatrick's evaluation model<sup>19</sup>, related to the student's reaction to the educational process.

The student group consisted of eight residents who were enrolled in the HUOL/UFRN Medical Residency Programs at the time of the study: three Nephrology residents, all of which were residents of the specialty at the time of the study, two attending the first year and one attending the second year; and, five residents of Internal Medicine, of which three were in the second year and two were in the first year.

There was a meeting with the group and, after signing the Free and Informed Consent form, the students were asked to include the atlas in their study routine for a period of fifteen days. At the end of this period, a focus group was held, led by a graduate student, and recorded by an assistant, whose guiding question was: *"How would you describe your learning experience while using the Atlas?"*. Data analysis was performed by the researcher and two more experienced professors from the postgraduate program, by reading the transcribed material, using the qualitative research technique of thematic analysis. The residents were not identified by name, being identified only by the year of graduation and through different colors in their speeches.

The project was approved by the HUOL Research Ethics Committee (CAAE: 135106019.1.0000.5292, on 06/14/2019).

**Figure 1.** Atlas home page layoutSource: NefroAtlas<sup>18</sup>**Figure 2.** Study guide through imagesSource: NefroAtlas<sup>18</sup>

**Figure 3.** Images with highlights and explanatory textsSource: NefroAtlas<sup>18</sup>

## DISCUSSION

The completion of a knowledge gap identified in our Medical Residency Program was carried out through the reading of material prepared and made available in a virtual way, at an asynchronous time to the Medical Residency activities, with the evaluation being obtained through the focus group, a moment for reflection on how residents reacted to this teaching strategy, being an important moment for the validation and development of this educational technology. This teaching method was in the spotlight during the coronavirus pandemic, when isolation made it necessary to develop Distance Learning strategies, and similar studies need to be carried out to understand the teaching process through the use of Information Technologies and Communication, which can be evaluated by the students. The evaluation of this process took place through a focus group, which was able to identify three emerging topics in its content (Chart 1).

### Teaching-learning experience

Positive points were highlighted regarding the learning experience with the NefroAtlas, which was described as a strategy that facilitates the acquisition of knowledge seen in practice, through the contextualization of the content:

*"The student starting the first week at the infirmary with this tool that explains the content in a very enlightening, illustrated way, would make it much easier. It is a study facilitator tool."* **Nephrology Resident – 2<sup>nd</sup> year**

*"the Atlas was extremely important at this moment because it was simultaneous, seeing the image and the explanations. This was something I had a lot of difficulty with, because even if you read the textbooks, you read that description, see the image, but you can't identify each change."* **Resident of Nephrology – 1<sup>st</sup> year**

The inclusion of renal pathology images, in general, is not a priority in the training of residents at our institution. The approach of students with the images provided by the platform was described as favorable in the learning experience:

*"It's very interesting for our daily routine, we can expect what's going to appear in the biopsy and see it. We have a very intimate contact with the biopsy."* **Internal Medicine Resident – 2<sup>nd</sup> year**

*"I think that if I had had the opportunity to use this tool at the time I spent in training it would have been easier to understand this issue of the association of pathology with the patient's clinical history."* **Internal Medicine Resident – 1<sup>st</sup> year**

**Figure 4.** Questions with the use of images and immediate feedback

**Questão 1**

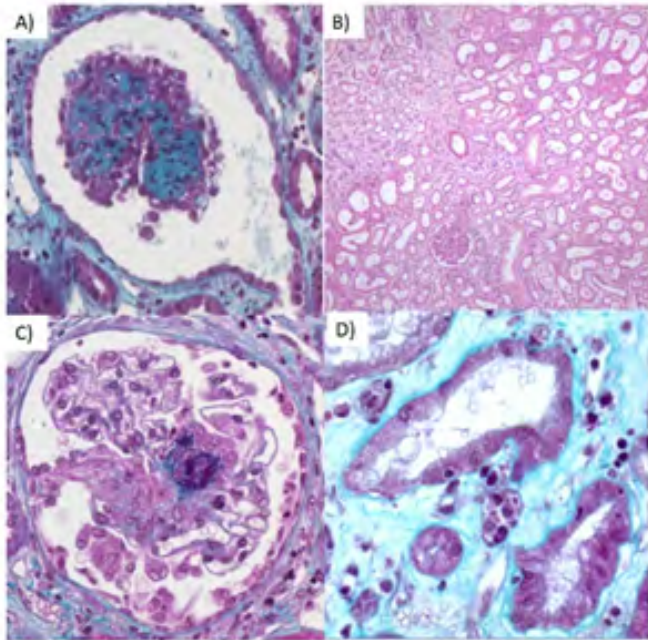


Imagem que se relaciona a critérios de cronicidade da classe IV:

A       C  
 B       D

**Feedback**

*Parabéns!*

*Imagem A – GESF colapsante – observa-se uma “coroa de podócitos” causando colapso da alça capilar. A GESF colapsante é descrita no LES, dentro das podocitopatias lúpicas, não estando na classificação do ISN/2004.*

*Imagem B – Fibrose intersticial e atrofia tubular – critério clássico de cronicidade, há presença de tecido entre os túbulos e áreas de irregularidade do lúmen tubular, denotando a atrofia.*

*Imagem C – Necrose de alça + crescente – presença de material fucsínofílico (vermelho mais intenso) no interior da alça, associado a crescente celular.*

*Imagem D – necrose tubular aguda – evidenciado áreas de desnudamento sobre a membrana basal tubular e células tubulares com aspecto necrótico – há picnose (redução nuclear) e cariólise (destruição do núcleo).*

Source: NefroAtlas<sup>18</sup>**Chart 1.** Emerging topics in the focus group in response to the question: “How would you describe the learning process using the NefroAtlas?”

1. Teaching-learning experience
2. Nefroatlas: structure, language, access to the platform and study time
3. Assessment of content development: “How would I (resident) do it?”

For the group of residents in the study, the NefroAtlas should be used in a complementary way, in order to consolidate the content learned at the time spent in Nephrology, in which they are introduced to actual clinical cases:

*"I think that for the daily routine of the infirmary it is a very good tool for us to correlate what we see in the residency with the atlas studies".* **Internal Medicine Resident – 1<sup>st</sup> year**

*"Really, it is very interesting to use the tool in our daily lives, especially in the infirmary, initially contextualizing with the cases that we see in the ward".* **Internal Medicine Resident – 2<sup>nd</sup> year**

The group's main concern was to identify which benefits were present in the online study process, and whether they had enough attributes to facilitate their process of acquiring new knowledge, actively seeking to improve previous knowledge from their training and the Medical Residency period.

This exposure was even superior to other concerns that motivate resident physicians to study, such as preparing for medical residency contests (for specializations that come after the residency in Internal Medicine) or Board Certification tests (which can be carried out at the end of the Nephrology residency), which were also mentioned in the focus group:

*"Some residency tests already include the interpretation of pathology slides".* **Internal Medicine Resident – 2<sup>nd</sup> year**

*"thinking further ahead regarding the Board Certification, right? So, it's something fundamental that we need to know about".* **Nephrology Resident – 1<sup>st</sup> year**

### NefroAtlas: structure, language, access to the platform and study time

There was some concern about the way the texts were presented, since it was necessary to adapt the online study to the routine of resident physicians with: flexibilization of access, clarity of language, easy reading and adaptation to the previously agreed study time<sup>20</sup>, since they were in full operation of their programs. In this regard, the resident physicians described the concern with the conceptual organization as positive, in which normal images of renal histology were presented, displaying basic knowledge before presenting the module in which the pathological alterations would be included:

*"first of all, we have contact with the normal kidney, which is really the most time consuming part of the study, but even so you can read quickly".* **Internal Medicine Resident – 2<sup>nd</sup> year**

*"also regarding the matter of the normal kidney. We always see pathological changes, so I liked to see what is normal first, and then see what is altered".* **Internal Medicine Resident – 1<sup>st</sup> year**

Regarding the dialogic language used to present the textual contents, the authors were concerned with the students' motivation to finish reading the entire content during the available period. This point was also taken into account among the points highlighted by the group, considering the language easy to understand and clear in the explanations contained in the texts:

*"I think that the language is very good, thinking about the Nephrology Resident, the Internal Medicine resident, who has just arrived and does not have this consolidated knowledge, and even the sixth-year medical student."* **Nephrology Resident – 2<sup>nd</sup> year**

*"an accessible, easy language, which I was able to understand well, it used a step by step approach and that made learning a lot easier".* **Nephrology Resident – 1<sup>st</sup> year**

*"I really liked the text, it is very practical, very direct, and uses a simple language, it is easy to understand".* **Internal Medicine Resident – 2<sup>nd</sup> year**

Since resident physicians dedicate a large part of their workload to activities developed in hospital practices, the study time should be adapted to this routine. The study group highlighted that the content available on the platform was accessed during available intervals, often in the hospital itself, where the use was allowed on cell phone devices and on desktop computers:

*"For the people attending the Residency, dedicating a lot of time to the activities, the access was quite easy, I had no problems".* **Internal Medicine Resident – 2<sup>nd</sup> year**

*"I thought it was good to be able to access it on my cell phone. We didn't need the computer or to be at home to study. I'm on a heavier rotation this month, so any free time I had, I was reading, because there was this question with free time."* **Internal Medicine Resident – 1<sup>st</sup> year**

A systematic review highlighted points mentioned by the study residents as positive for the successful use of e-learning by health professionals, such as: (a) facilitating the learning (through contextualization, having resources that provide the teacher with new ways of teaching the content, expanding the knowledge, flexibility of use); (b) integration of theoretical knowledge with practical application (use of clinical cases, learning that promotes changes in their practical performance, possibility of including knowledge in clinical discussions at the bedside); and, (c) systematization of the content (presentation

from the “simple to the most complex”). The main difficulties mentioned in this review were not highlighted in the focus group of our study (such as lack of motivation for its conclusion or the residents’ low level of knowledge regarding the use of information technologies), or were highlighted among the positive aspects (time, cost and effort spent to complete it)<sup>21</sup>.

The main difficulty reported by resident physicians was associated with the fact that not all resources were appropriate for all cell phone devices during the study period. This unavailability happened to some students, but it did not prevent or discourage them from seeking other devices to solve the problem:

*“I used of the platform on the computer, because I initially tried to use it on the*

*cell phone, and I had difficulty”.* **Internal Medicine Resident – 2<sup>nd</sup> year**

*“I had a problem when viewing on my cell phone, because I couldn’t see it in full screen”.* **Internal Medicine Resident – 2<sup>nd</sup> year**

### How would I (resident) do it?

A discussion about the content was present in the focus group: while residents of Nephrology had the impression that the content would be extensive, residents of Internal Medicine residents assessed that the content contained more explanations to facilitate the group’s understanding. The conflict of opinions between physicians of different levels identifies the need for content writers to know the level of training of the target audience of their teaching activity, since individual expectations for using the platform vary:

*“I think that because the Nephrology residents already had a greater experience than the Internal Medicine residents, we ended up thinking that there were texts explaining too much. Thus, the texts became long because we already have this knowledge consolidated but depending on the group that is using the Atlas, the information is really not unnecessary”.* **Nephrology Resident – 1<sup>st</sup> year**

*“I think that regarding this issue of being quite extensive for Nephrology residents, because they already had some more knowledge than the Internal Medicine resident. Maybe having two sessions: one for Internal Medicine residents and students who would have a little more explanation; and some more focused on images, on the issue of pathology, for the specialists”.* **Internal Medicine Resident – 1<sup>st</sup> year**

In order to further highlight the main topics to be learned, there was a request for the re-presentation of the content as a summary table:

*“perhaps a suggestion would be to make a summary box at the end of each chapter.”* **Internal Medicine Resident – 2<sup>nd</sup> year**

*“I think I would not remove the texts, but I would put a summary chart at the end”.* **Internal Medicine Resident – 2<sup>nd</sup> year**

The excess of textual content contrasted with the request for a greater number of pathology images:

*“I agree, I believe they could include more different cuts of the same alteration, because I think the more images we saw of that change, the better we would memorize it.”* **Internal Medicine Resident – 1<sup>st</sup> year**

*“Having more different images of the same finding. That is fundamental”.* **Nephrology Resident – 1<sup>st</sup> year**

Regarding the use of the platform, some resources that make the learning experience more dynamic and varied were emphasized by the participants, who recalled previous experiences, requesting the inclusion of more interactive study strategies and diversifying the means of presenting the contents:

*“A large picture of the slide and being capable of using the mouse to highlight a structure. It would include several highlighted structures, as we can see in several image atlases, and include the caption of what that would be.”* **Internal Medicine Resident – 2<sup>nd</sup> year**

*“In my undergraduate course in Pathology, I remember that when we had practical classes, we would go to those microscopes and stay with the teacher and he would show us the slides, pointing out the structures, I think it would be good to try to do something similar”.* **Internal Medicine Resident – 1<sup>st</sup> year**

*“A suggestion is to add audio content”.* **Nephrology Resident – 2<sup>nd</sup> year**

Although there have been efforts by teachers to generate virtual content for teaching, the students’ assessment of the learning experience is a fundamental part of the process of teacher improvement. There are barriers to the construction of online teaching strategies, even for experienced trainers, which are related to the trainer’s personal characteristics (less ability to use technology and information resources), the developed work (activity overload, lack of time and funding), and even institutional ones. At this point, mutual collaboration between services, as in the developed partnerships, and even the development of content by resident physicians during the project are favorable to the development of innovative teaching strategies<sup>22</sup>.

Other points of improvement presented by the resident physicians (suggestions on the inclusion of more interactive resources, increase in visual content, expansion to multimedia resources) are based on the expectation of the student who

is skilled in technologies, and who has other online teaching experiences, seeking to vary the ways of receiving content. The in-person contact between preceptor and student is an indispensable part during the Medical Residency training, which cannot be replaced by exclusive online teaching activities<sup>23</sup>; nevertheless, its lack during the learning process was not mentioned during the focus group.

## CONCLUSIONS

The best strategy for using educational technologies in Medical Residency is to include it as a complementary method to practical teaching, through Blended Learning. This method can favor inter-institutional partnerships and fill the gaps in human and technological resources. The inclusion of residents as authors of these products can help to develop the content and improve teacher training. In addition, the approximation of training centers, where the Medical Residency Programs are located, which are capable of identifying learning gaps, with training centers in the areas of Information Technology can help the teacher in the construction of innovative teaching activities, to optimize resources and benefit the students' learning experience.

## AUTHORS' CONTRIBUTION

Felipe Leite Guedes: Content development on the teaching platform; Responsible for the qualitative research; Analysis of qualitative research; Manuscript writing. Gyl Eanes Barros da Silva: Content development on the teaching platform; Selection of medical images to be used on the platform; Manuscript review. Leonardo Peres de Melo Goulart: Development of the educational technology; Support to the use of the platform during the research; Collaboration in the creation of the textual contents of the article. Arthur Cohen Costa dos Santos: Development of the educational technology; Support o the use of the platform during the research; Collaboration in the creation of the textual contents of the article. Anna Giselle Câmara Dantas Ribeiro Rodrigues: Assistance in the development of the educational technology; Support to the use of the platform during the research; Collaboration in the creation of the textual contents of the article; Manuscript review. José Diniz Júnior: Assistance in the development and publication of the educational technology; Platform content review; Review of the Thematic Analysis of the qualitative research; Writing and review of the manuscript.

## CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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